We claim:

1. A process for measuring the gas transmission rate of a deformable or brittle test material sample comprising:
   (a) providing a test chamber including an upper diffusion cell and a lower diffusion cell that when closed form a chamber wall seal, a gas inlet and a gas outlet in fluid communication with the lower diffusion cell and a mass spectrometer in communication with the upper diffusion cell;
   (b) selecting a guard material of a known type and positioning said guard material between the lower diffusion cell and the upper diffusion cell;
   (c) closing the upper and lower diffusion cells;
   (d) providing through said gas inlet a source of a test gas and exhausting said test gas through said gas outlet;
   (e) operating a mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;
   (f) measuring the gas transmission rate of the guard material;
   (g) opening the upper and lower diffusion cells of the test chamber to remove the guard material and position a deformable or brittle test material sample between the upper diffusion cell and the lower diffusion cell immediately adjacent the lower diffusion cell;
   (h) placing the guard material over the test material sample and immediately adjacent the upper diffusion cell;
   (i) closing the upper and lower diffusion cells;
   (j) providing through said gas inlet a source of a second gas different from said test gas and not measurable by the mass spectrometer and exhausting said second gas through said gas outlet;
   (k) operating the mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;
   (l) calculating the leak rate of the chamber wall seals;
   (m) maintaining the positions of the guard material and test material sample and providing through said gas inlet into said lower diffusion

cell a source of said test gas and exhausting said test gas through said gas outlet;

(n) operating the mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;

(o) measuring the combined gas transmission rate of the guard material and the test material sample;

wherein the gas transmission rate of the test material sample is calculated by (i) subtracting the chamber wall leak rate from the combined gas transmission rate of the guard material and the test material sample and calculating the reciprocal; (ii) calculating the reciprocal of the gas transmission rate of the guard material and subtracting it from the value obtained at (i); and calculating the reciprocal value of the result obtained in (ii) to obtain the test material transmission rate.

2. The process of claim 1 including positioning a support grid over said guard material and immediately adjacent said upper diffusion cell in steps (b), (h) and (m).
3. The process of claim 2 wherein said support grid is porous metal.
4. The process of claim 1 wherein the guard material has a high gas transmission rate.
5. The process of claim 1 wherein the guard material has a gas transmission rate one hundred times greater than the gas transmission rate of the test material sample.
6. The process of claim 1 wherein the guard material is selected from the group consisting essentially of polyesters, polycarbonates, and polystyrenes.
7. The process of claim 6 wherein the guard material is a polyester.
8. The process of claim 7 wherein the guard material is polyethylene terephthalate.
9. The process of claim 1 wherein said test gas is introduced into the lower diffusion cell at a rate of approximately 10cc per minute.
10. The process of claim 1 wherein said second gas is introduced into the lower diffusion cell at a rate of approximately 10cc per minute.

11. An apparatus for measuring the gas transmission rate of deformable and brittle test materials comprising a test chamber including an upper diffusion cell and a lower diffusion cell that when closed forms a chamber wall seal, a gas inlet and a gas outlet in fluid communication with the lower diffusion cell and a mass spectrometer in communication with the upper diffusion cell; a test material sample positioned between said upper and lower diffusion cells; and a guard material positioned over the test material sample and immediately adjacent the upper diffusion cell.

12. A process for measuring the gas transmission rate of a deformable or brittle test material sample comprising:

(a) providing a test chamber including an upper diffusion cell and a lower diffusion cell that when closed form a chamber wall seal, a gas inlet and a gas outlet in fluid communication with the lower diffusion cell and a mass spectrometer in communication with the upper diffusion cell;

(b) selecting a guard material of a known type and positioning said guard material between the lower diffusion cell and the upper diffusion cell;

(c) closing the upper and lower diffusion cells;

(d) providing through said gas inlet a source of a test gas and exhausting said test gas through said gas outlet;

(e) operating a mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;

(f) measuring the gas transmission rate of the guard material;

(g) opening the upper and lower diffusion cells of the test chamber to remove the guard material and position a deformable or brittle test material sample between the upper diffusion cell and the lower diffusion cell immediately adjacent the lower diffusion cell;

(h) placing the guard material over the test material sample and immediately adjacent the upper diffusion cell;

(i) closing the upper and lower diffusion cells;

(j) providing through said gas inlet into said lower diffusion cell a source of said test gas and exhausting said test gas through said gas outlet;

(k) operating the mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;

(l) measuring the combined gas transmission rate of the guard material and the test material sample;

wherein the gas transmission rate of the test material sample is calculated by (i) calculating the reciprocal of the combined gas transmission rate of the test material sample and the guard material; (ii) calculating the reciprocal of the gas transmission rate of the guard material and subtracting it from the value obtained at (i); and calculating the reciprocal value of the result obtained in (ii) to obtain the test material transmission rate.

13. The process of claim 12 including positioning a support grid over said guard material and immediately adjacent said upper diffusion cell in steps (b) and (h).

14. The process of claim 13 wherein said support grid is porous metal.

15. The process of claim 12 wherein the guard material has a high gas transmission rate.

16. The process of claim 12 wherein the guard material has a gas transmission rate approximately one hundred times greater than the gas transmission rate of the test material sample.

17. The process of claim 12 wherein the guard material is selected from the group consisting essentially of polyesters, polycarbonates and polystyrenes.

18. The process of claim 17 wherein the guard material is a polyester.

19. The process of claim 18 wherein the guard material is polyethylene terephthalate.

20. The process of claim 12 wherein the test gas is introduced into the lower diffusion cell at a rate of approximately 10 cc per minute.

21. A method for measuring the gas transmission rate of a sealed manufactured package containing a test gas comprising:

(a) providing a test chamber including an upper diffusion cell and a lower diffusion cell that when closed form a chamber wall seal, a gas valve inlet and a gas valve outlet in fluid communication with the lower

diffusion cell and a mass spectrometer in communication with the upper diffusion cell;

(b) placing a sealed package containing a test gas in the lower diffusion cell;

(c) selecting a guard material of a known type and positioning said guard material between the lower diffusion cell and the upper diffusion cell;

(d) positioning a support grid over the guard material and immediately adjacent the upper diffusion cell;

(e) closing the upper and lower diffusion cells;

(f) opening said gas inlet valve and said gas outlet valve;

(g) providing through said gas inlet valve and out said gas outlet valve a source of a second gas different than the test gas to flush the lower diffusion chamber;

(h) closing said gas inlet and gas outlet valve;

(i) operating a mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;

(j) measuring the gas transmission rate of the sealed package;

wherein the guard material has a known gas transmission rate that is significantly greater than the gas transmission rate of the sealed package and wherein the gas transmission rate of the sealed package is calculated by calculating the reciprocal of the gas transmission rate of the sealed package.

22. A method for measuring the gas transmission rate of a sealed manufactured package containing a test gas comprising:

(a) providing a test chamber including an upper diffusion cell and a lower diffusion cell that when closed form a chamber wall seal, a gas valve inlet and a gas valve outlet in fluid communication with the lower diffusion cell and a mass spectrometer in communication with the upper diffusion cell;

(b) selecting a guard material of a known type and positioning said guard material immediately adjacent the lower diffusion cell;

(c) positioning a support grid over the guard material immediately adjacent the upper diffusion cell;

(d) closing the upper and lower diffusion cells;

(e) opening said gas inlet valve and said gas outlet valve;

(f) providing through said gas inlet valve a source of a test gas;

(g) operating a mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;

(h) measuring the gas transmission rate of the guard material;

(i) opening the upper and lower diffusion cells of the test chamber to remove the guard material and support grid and placing a sealed package containing the test gas in the lower diffusion chamber and repositioning said guard material immediately adjacent the lower diffusion chamber and the support grid immediately adjacent the upper diffusion chamber;

(j) closing the upper and lower diffusion cells;

(k) opening the gas inlet valve and the gas outlet valve;

(l) providing through said gas inlet valve into the lower diffusion cell a second gas different that said test gas to flush the lower diffusion cell;

(m) closing said gas inlet valve and said gas outlet valve;

(n) operating the mass spectrometer thereby creating a high-vacuum system in the upper diffusion cell;

(o) measuring the gas transmission rate of the combined sealed package and guard material;

wherein the gas transmission rate of the sealed package is calculated by (i) calculating the reciprocal of the combined sealed package and guard material; (ii) calculating the reciprocal of the gas transmission rate of the guard material and subtracting it from the value obtained at (i); and calculating the reciprocal value of the result obtained in (ii) to obtain the gas transmission rate of the sealed package.